

CLAIMS

What is claimed is:

1. A method of forming a metallic silicide film and dielectric cap during a gate stack formation wherein said gate stack formation includes a polysilicon layer, the method comprising:
forming a metallic silicide film in a non-annealed state over said polysilicon layer; and
forming a dielectric cap on said metallic silicide film at a sufficiently low temperature
that said metallic silicide film remains in said non-annealed state.

10 2. The method of claim 1, wherein said forming a metallic silicide film in
said non-annealed state over said polysilicon layer is effected at a temperature below
about 600° C.

15 3. A method of forming a gate stack, comprising:
forming a gate dielectric layer on a silicon substrate;
forming a polysilicon layer on top of the gate dielectric layer;
subjecting said polysilicon layer to an ion implantation of impurities;
depositing a metallic silicide film in a non-annealed state atop said polysilicon layer; and
depositing a dielectric cap layer over said metallic silicide film at a sufficiently low
temperature such that the metallic silicide film remains in said non-annealed state.

20 4. The method of claim 3, wherein said depositing a dielectric cap layer over
said metallic silicide film is effected at a temperature of between 400° C. and 600° C.

25 5. The method of claim 3, wherein said depositing a dielectric cap layer over
said metallic silicide film is effected at a temperature of about 500° C.

6. The method of claim 3, wherein said depositing a dielectric cap layer over said metallic silicide film is effected at a temperature sufficiently low to maintain said metallic silicide film in said non-annealed state.

5 7. The method of claim 3, wherein said depositing a dielectric cap layer over said metallic silicide film is effected at a temperature sufficiently low to preclude formation of silicon clusters in said metallic silicide film.

10 8. The method of claim 3, further comprising forming said dielectric cap layer of silicon nitride.

9. The method of claim 3, further comprising forming said metallic silicide film as a cobalt silicide film.

15 10. The method of claim 3, further comprising forming said metallic silicide film as a molybdenum silicide film.

11. The method of claim 3, further comprising forming said metallic silicide film as a titanium silicide film.

20 12. The method of claim 3, further comprising forming said metallic silicide film as a tungsten silicide film.

25 13. The method of claim 3, further comprising forming said metallic silicide film as a silicon rich metallic silicide film.

14. The method of claim 3, further comprising forming said metallic silicide film with a non-crystalline structure.

15. The method of claim 3, wherein said depositing said dielectric cap layer over said metallic silicide film comprises selectively depositing silicon nitride by plasma-enhanced chemical vapor deposition.

5 16. The method of claim 3, wherein said depositing said dielectric cap layer is achieved using a deposition technique selected from the group consisting of chemical vapor deposition, sputtering, and spin-on techniques.

10 17. A method for forming a gate stack, comprising:
providing a semiconductor substrate with a dielectric layer on an active surface of said semiconductor substrate, wherein a polysilicon layer is disposed over said dielectric layer;
forming a metallic silicide film in a non-annealed state over said polysilicon layer;
forming a dielectric cap on said metallic silicide film at a sufficiently low temperature
15 that said metallic silicide film remains in said non-annealed state;
forming and patterning a resist layer on said dielectric cap;
etching said dielectric cap, said metallic silicide film, and said polysilicon layer; and
stripping said resist layer.

20 18. The method of claim 17, wherein forming said dielectric cap is effected at a temperature below about 600° C.

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